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Methane Emissions
Reduction Potentials and Costs

A discussion on Near-term Strategies for Slowing Warming in the Arctic:
Focus on Methane
Washington DC, USA
February 4, 2009

Outline

1. Methodology
2. Global emission trends
3. Sources of CH_4
4. Mitigation options
5. Marginal abatement cost curve
6. Options below 40€/t CO_2eq
7. CH_4 mitigation in context
8. Caveats
9. Conclusions

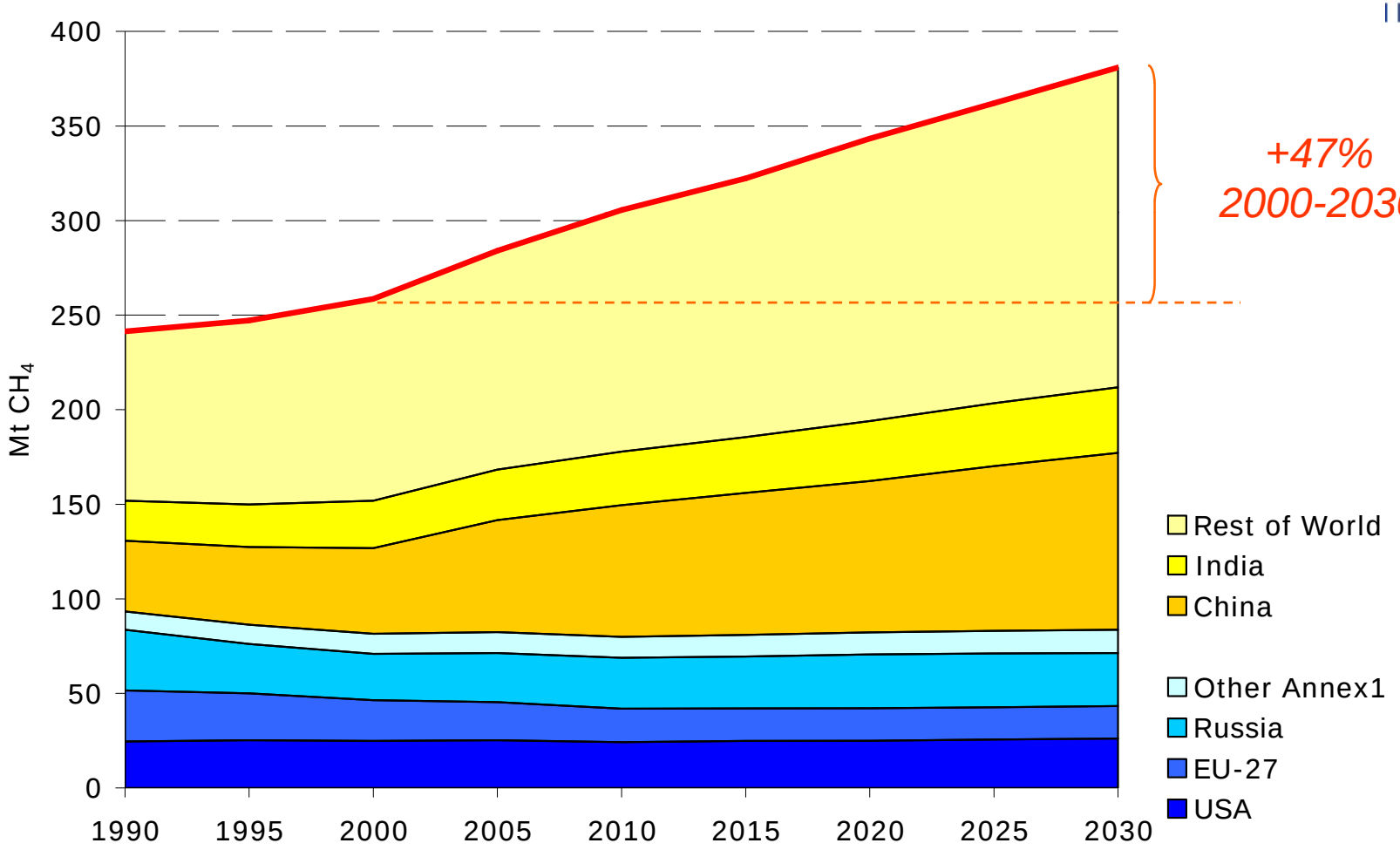
Methodology: The GAINS model

- Integrated Assessment model with a long history
- uses IPCC methodology (Tier 1 and 2)
- has been employed by European Commission for the EU-burden sharing agreement for the 20-20-20 targets.

- More than 100 source categories for CH_4
- Approx. 90 measures that influence CH_4 emissions
  - Abated emission factors
  - Unit costs
- Emission projections based on
  - Activity projections of IEA World Energy Outlook 2008
  - Local emission factors (GAINS-Europe/Asia)
  - Implementation of current national emission control legislation

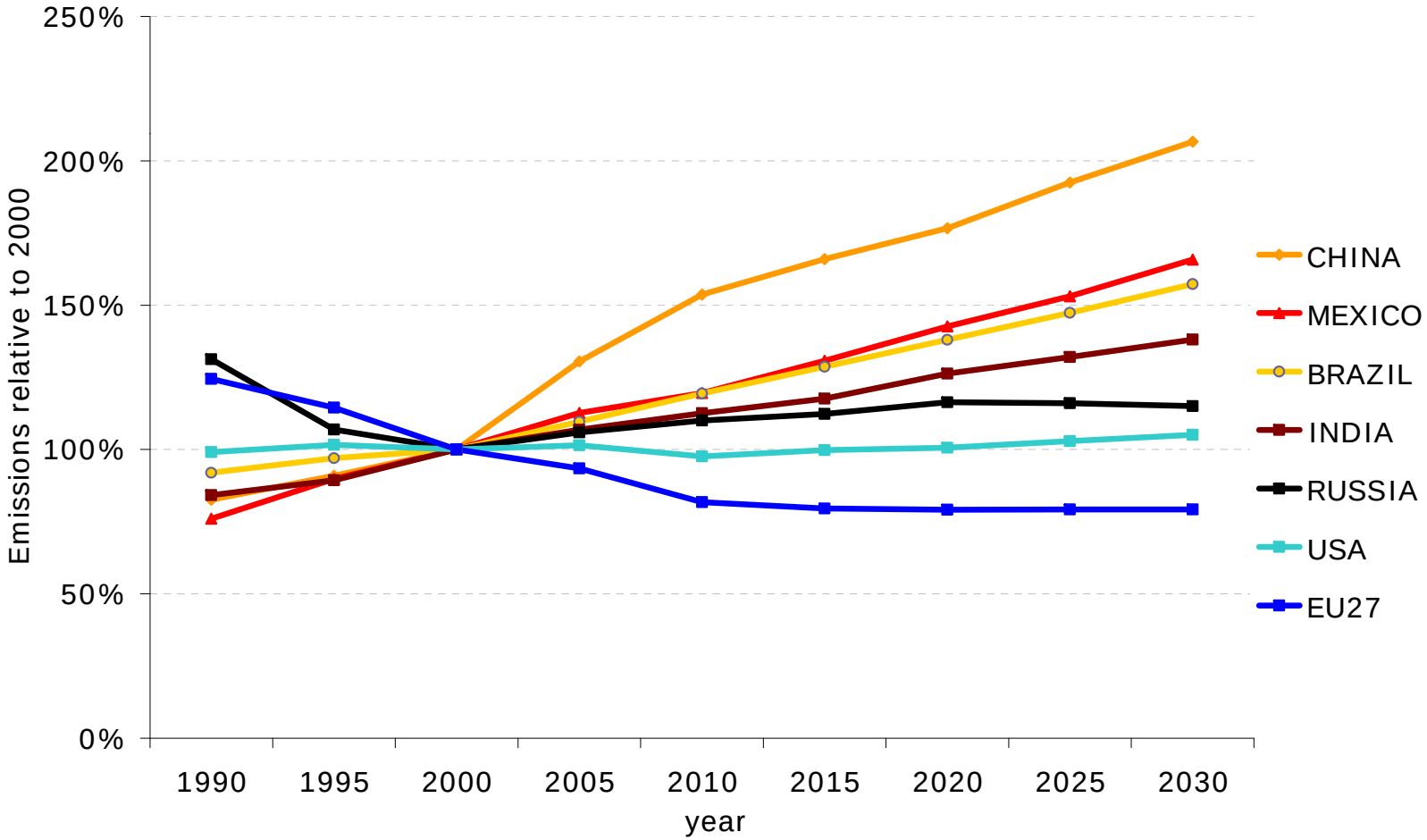
GAINS-World covers some 190 geographical areas
National, sub-national & regional

Global CH_4 emission baseline projection: Average growth rate: 1.3% p.a.

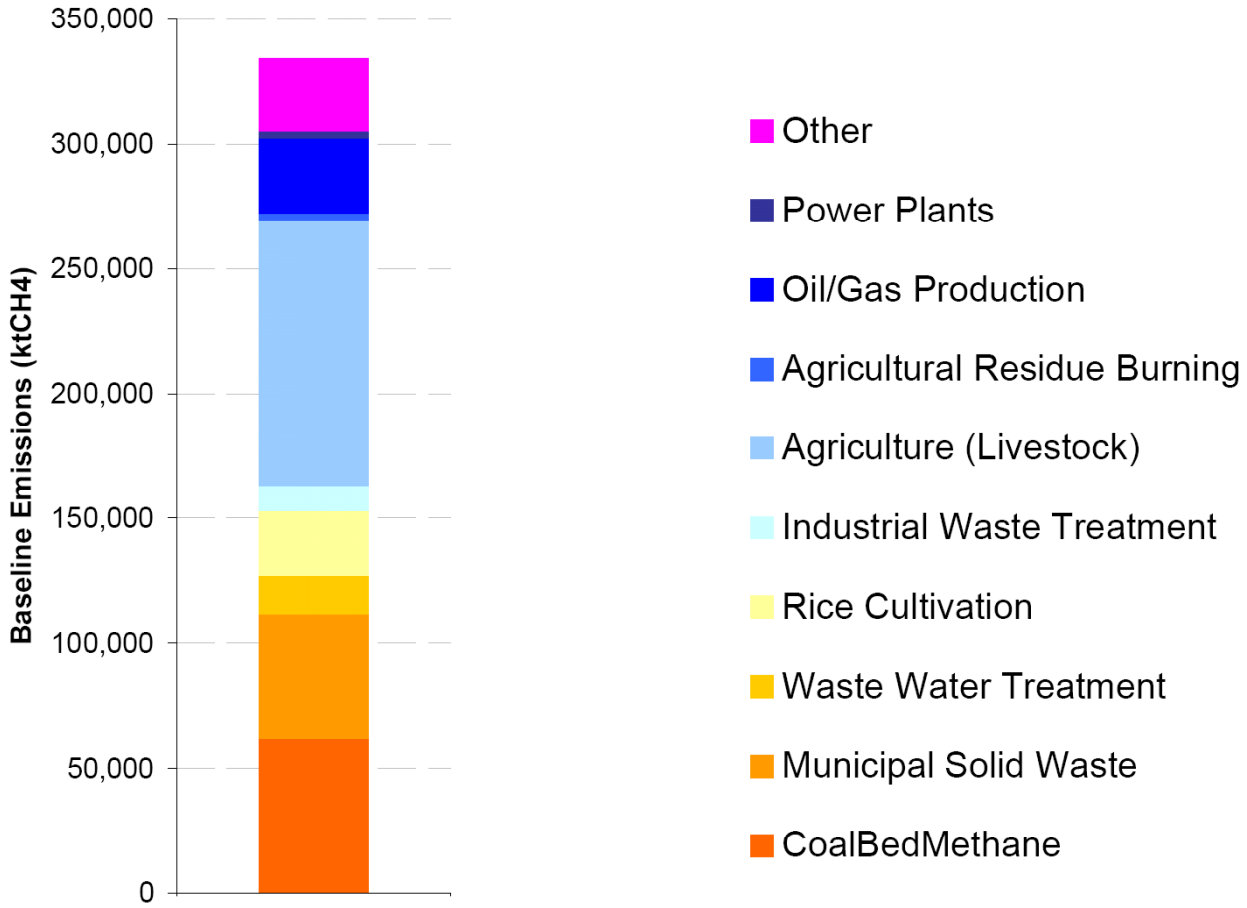


TOP 7 emitters of methane

Baseline trends



Future sources:
Global CH_4 baseline projection for 2020, by sector



CH_4 mitigation measures
considered in GAINS (1)

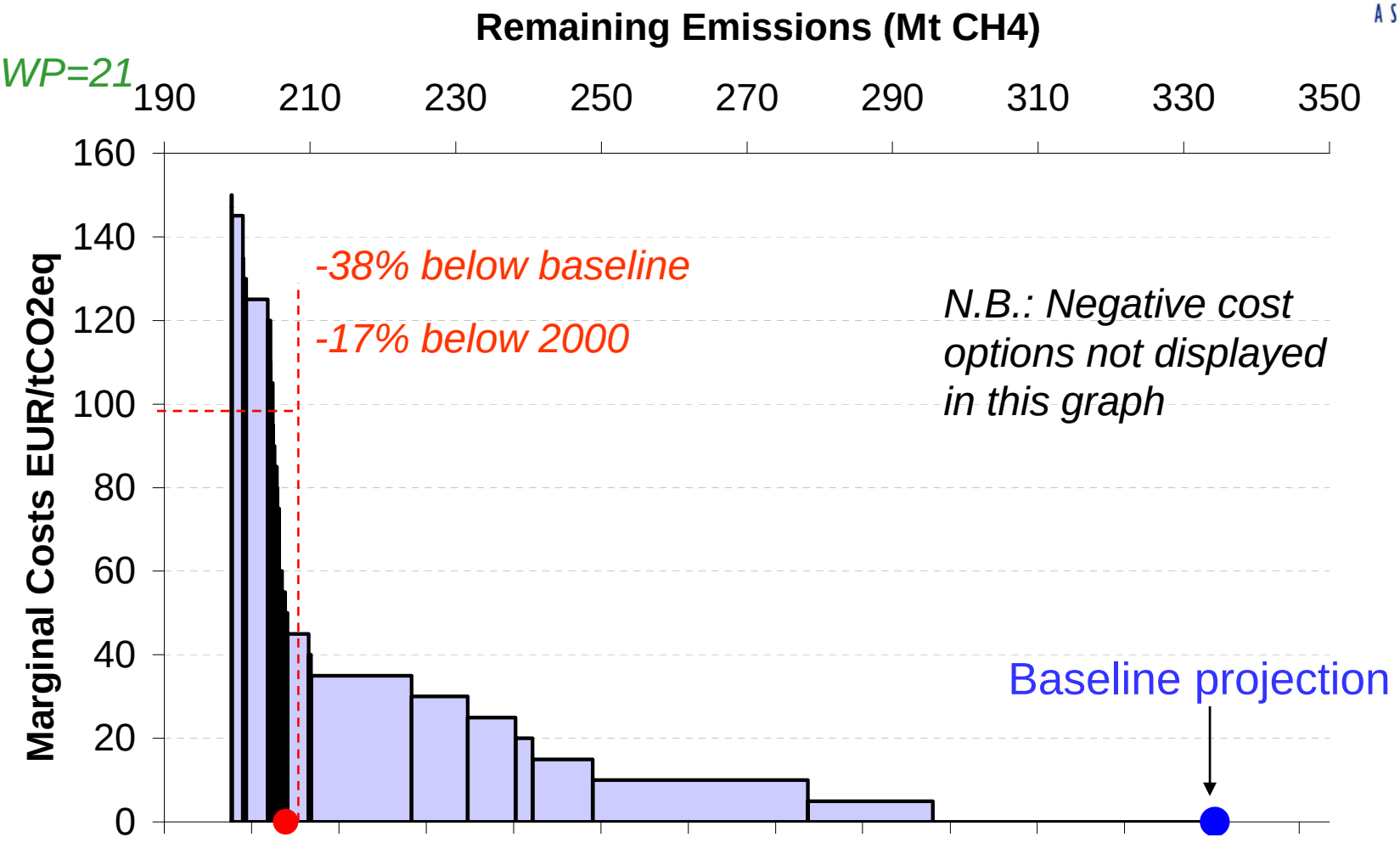
Agriculture	▪Anaerobic digestion of animal manure ▪Dietary changes for dairy cows and cattle ▪Alternative rice strains and improved aeration of rice fields. ▪Ban on agricultural waste burning
Waste	▪Waste diversion options: recycling of paper and wood waste, composting and biogasification of food waste, and waste incineration ▪Landfill options: gas recovery with flaring or gas utilization
Waste-water	▪Domestic urban wastewater collection with aerobic or anaerobic treatment with or without gas recovery. ▪Domestic rural wastewater treatment in latrines or septic tanks. ▪Industrial wastewater treatment, aerobic or anaerobic with or without gas recovery utilization

CH_4 mitigation measures
considered in GAINS (2)

Coal mining	▪Recovery with flaring or utilization of gas
Gas distribution	▪Replacement of grey cast iron networks and increased network control frequency
Natural gas and oil production and processing	▪Recovery and flaring of gas

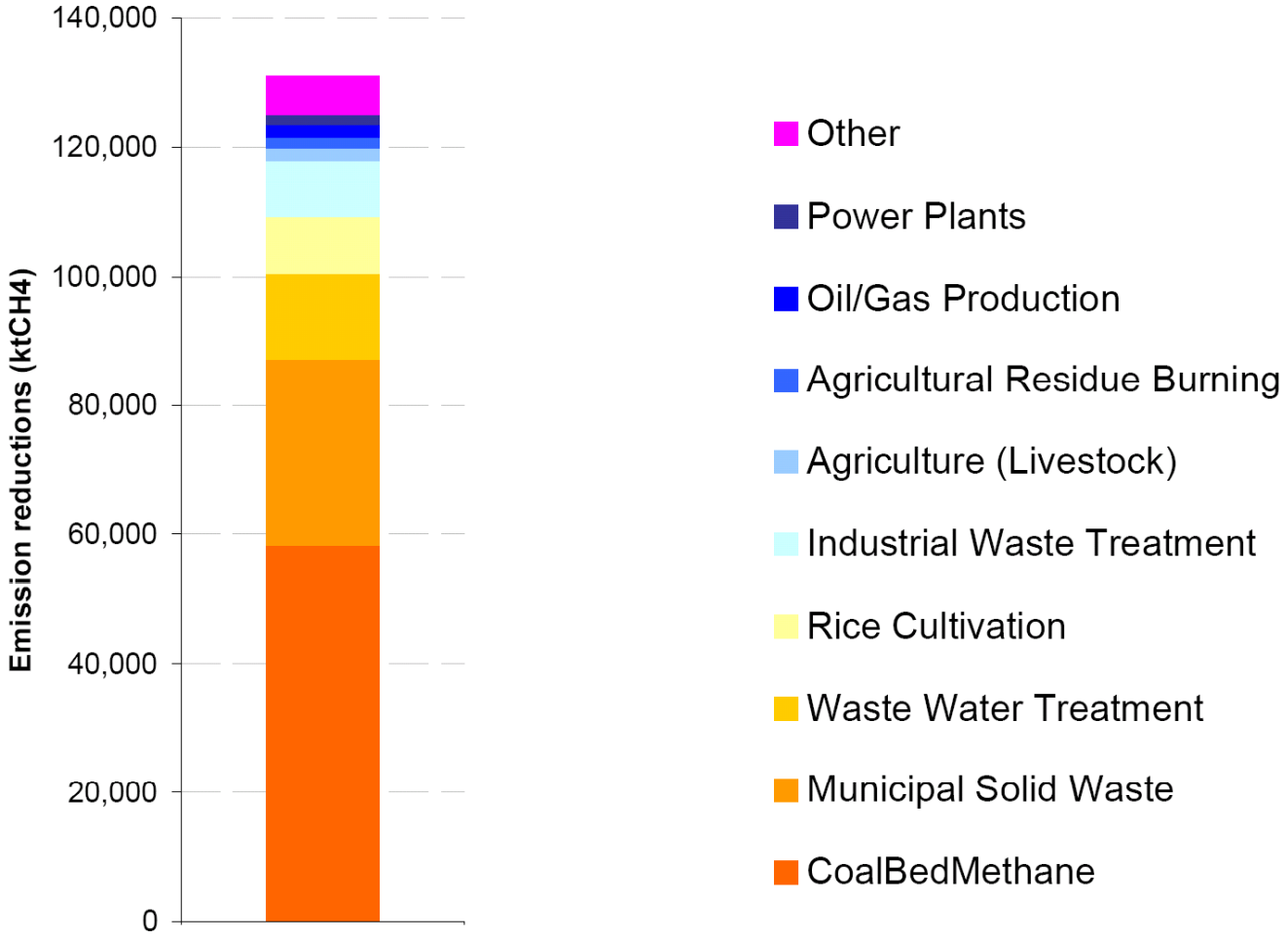
Marginal CH_4 abatement cost curve

World, 2020 (4% interest rate)



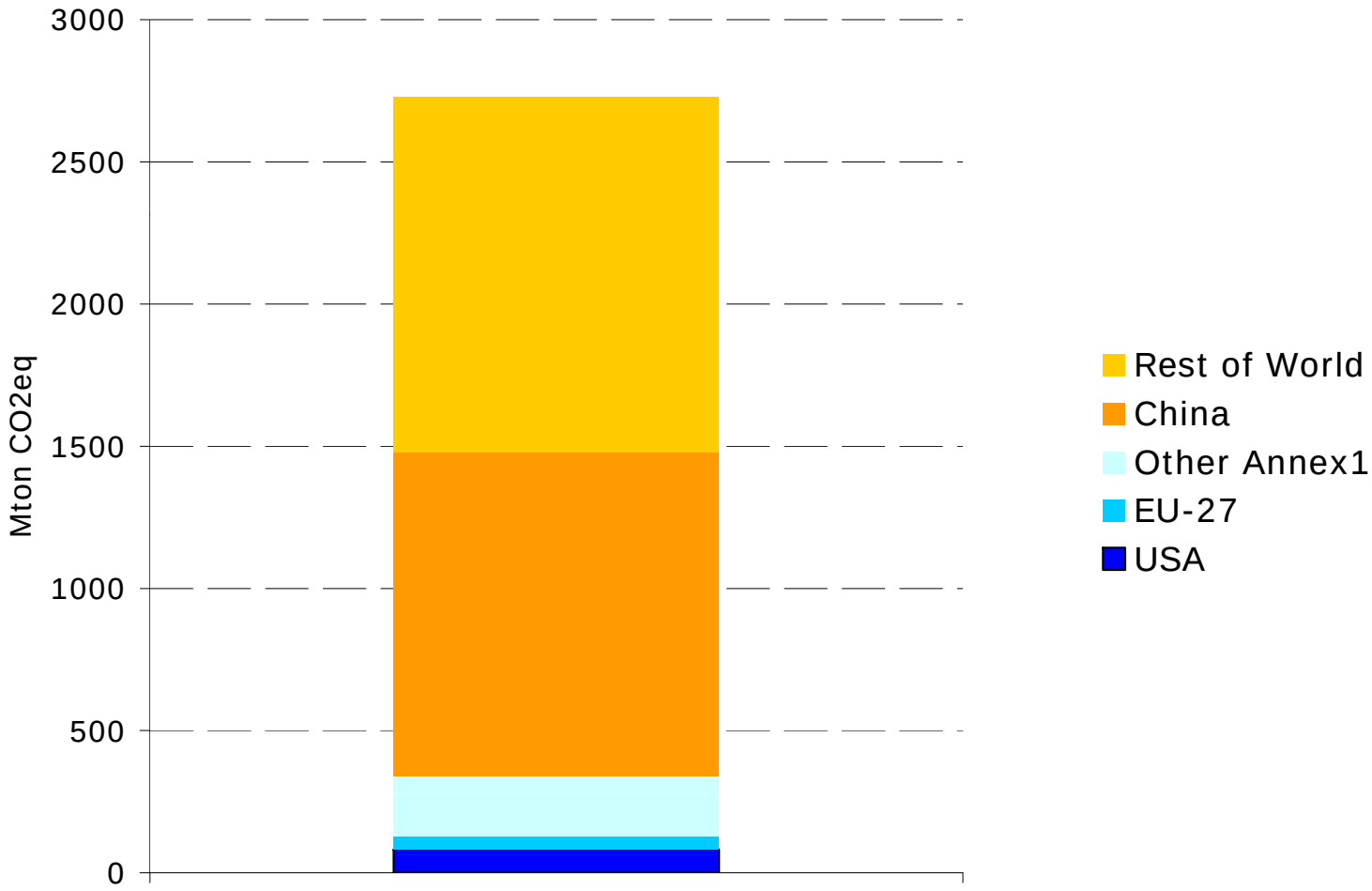
Key CH_4 mitigation measures <40 €/ton CO_2eq

World, 2020

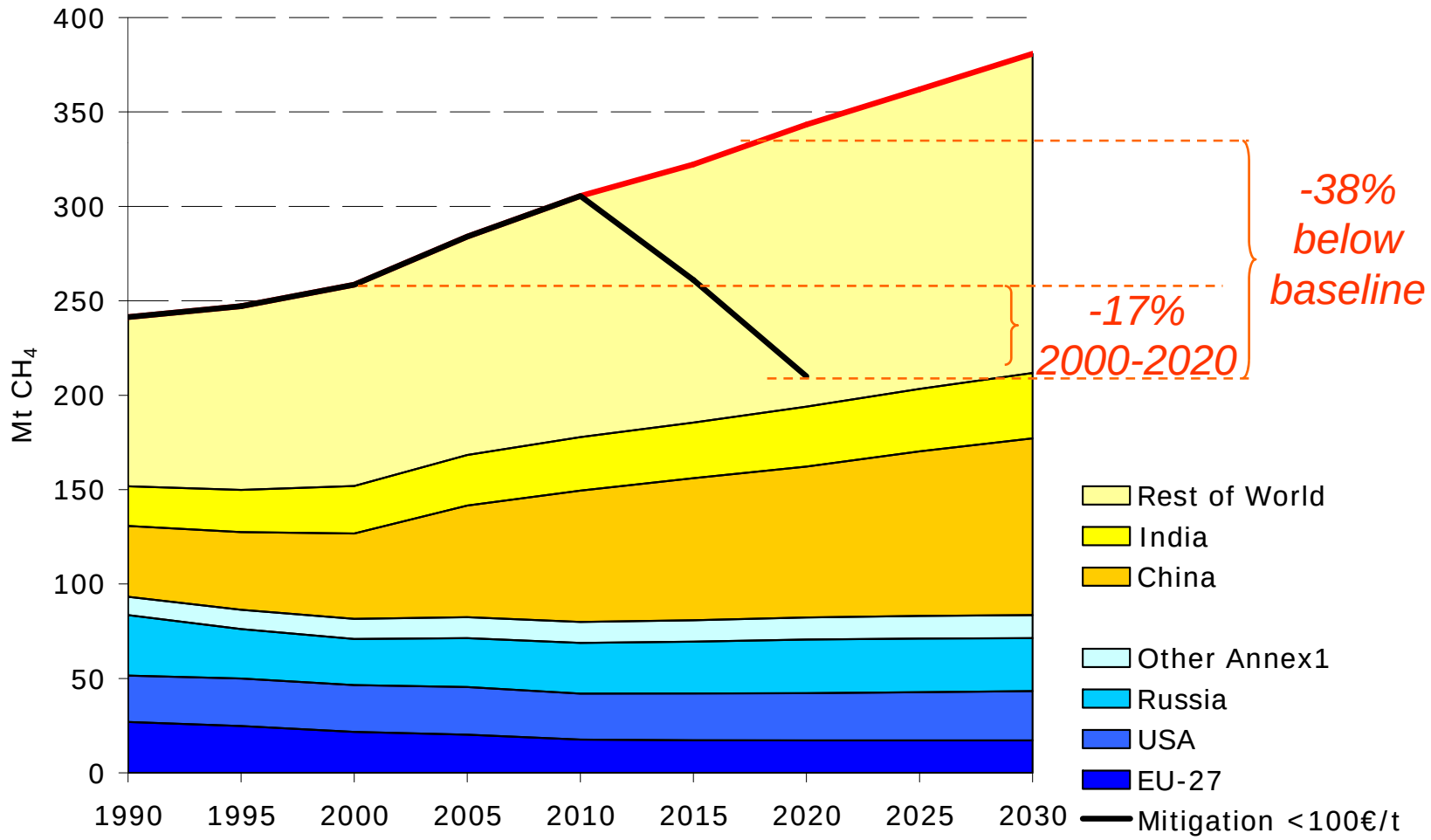


CH_4 mitigation potential <40 €/ton CO_2eq

2020, by World region



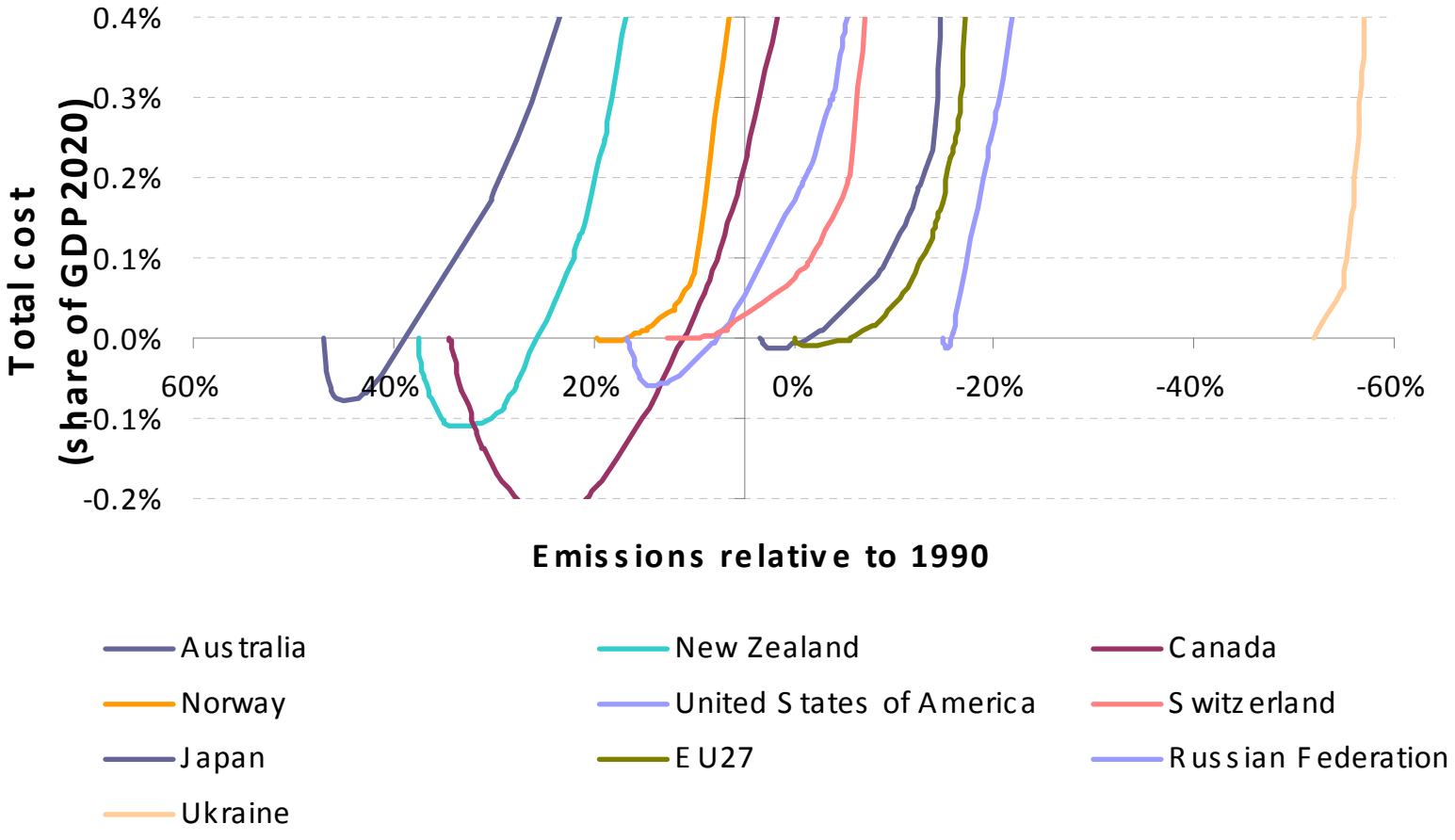
Global CH_4 could decline by 17% at <40€/t CO_2eq



GAINS GHG mitigation cost curves

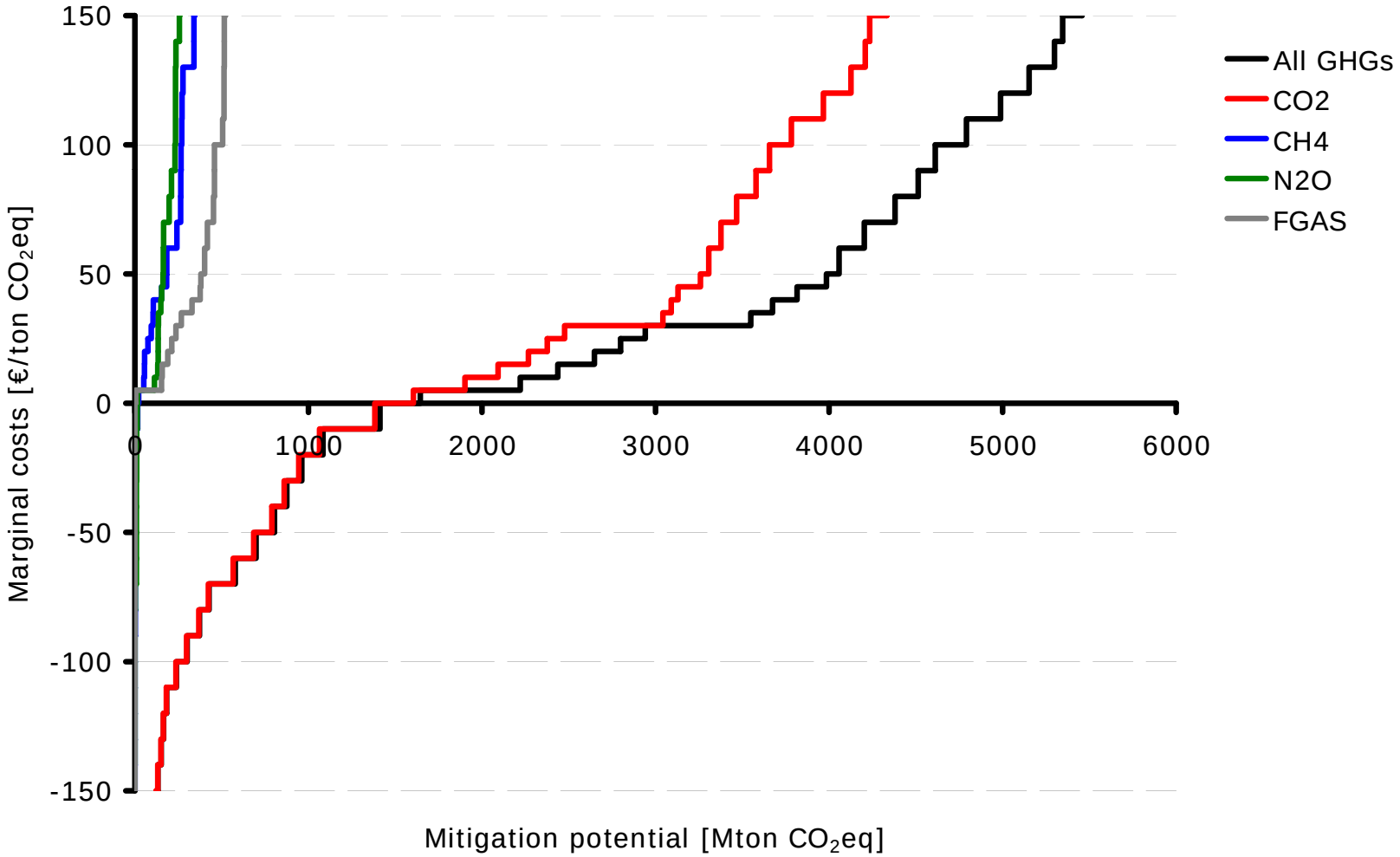
for Annex 1 Parties, 2020, all GHGs

http://gains.iiasa.ac.at/



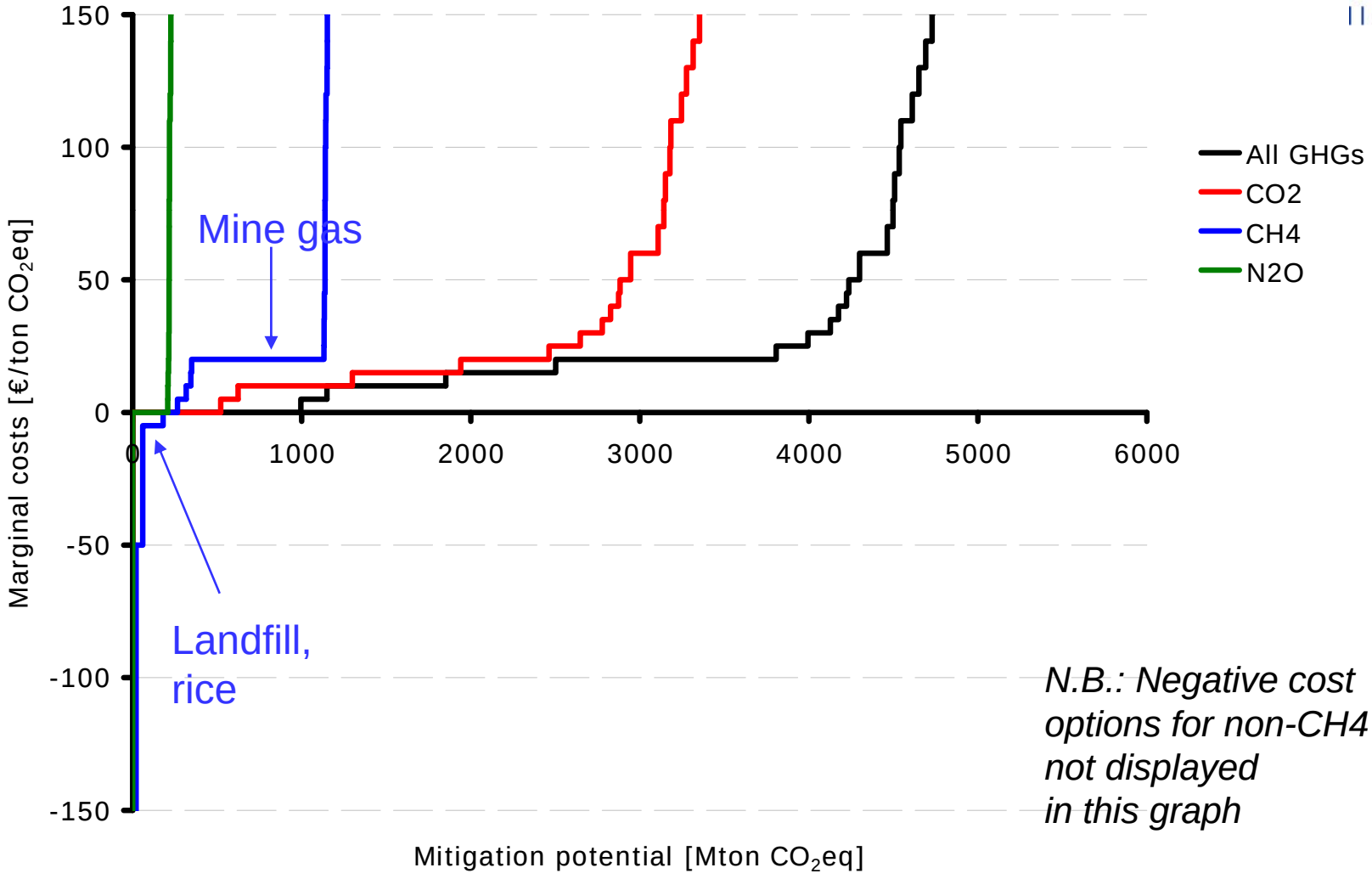
GAINS GHG mitigation cost curves

Annex 1 Parties, 2020, by gas



GAINS GHG mitigation cost curves

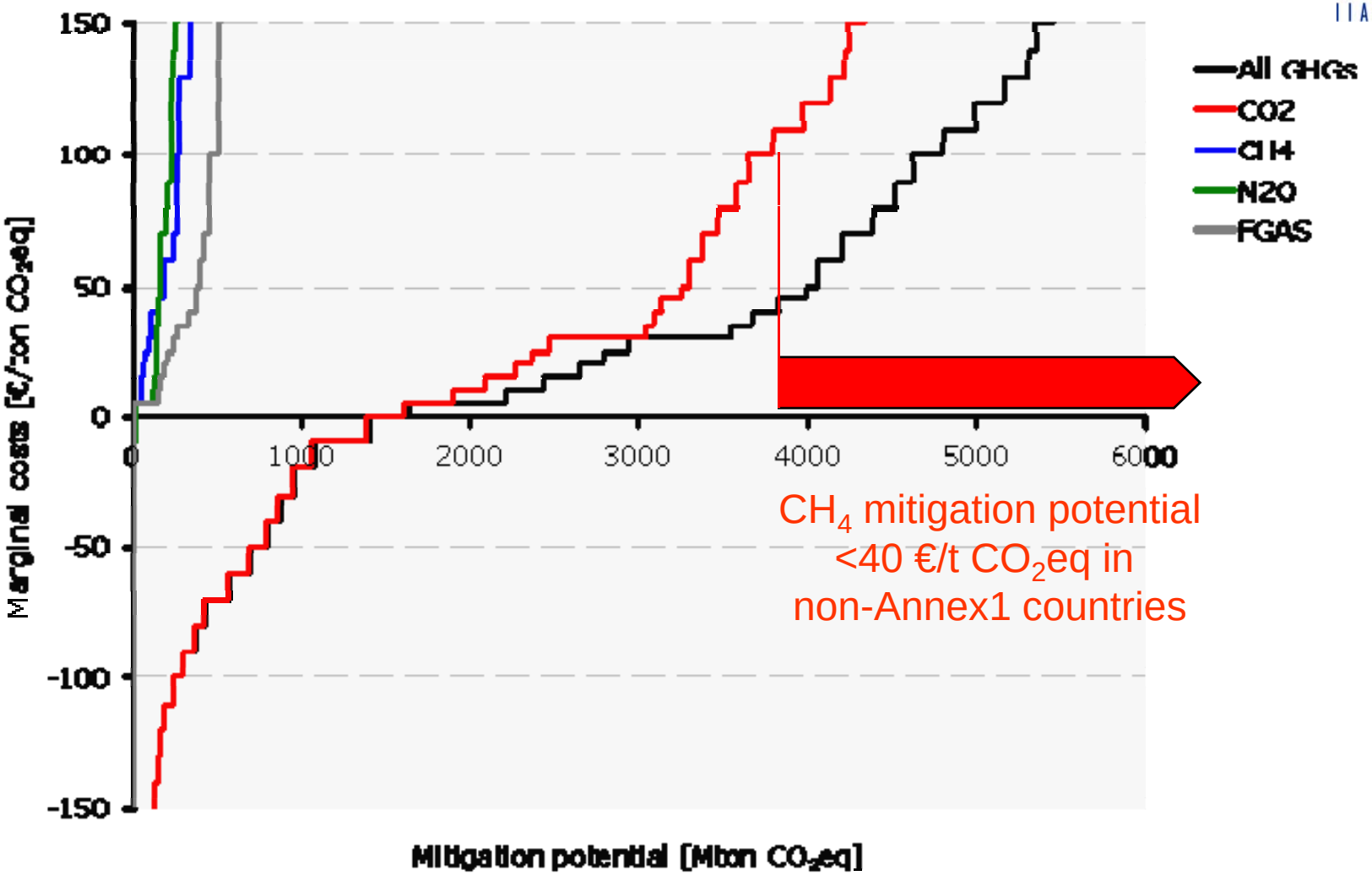
China, 2020, by gas



N.B.: Negative cost options for non-CH4 not displayed in this graph

GAINS GHG mitigation cost curves

Annex 1 Parties, 2020, by gas



Issues

Uncertainties in emissions

- Emission factors
- Implementation rates (e.g., venting vs flaring)

Costs

- Which discount rate to use? Here: 4%
- Local costs vs MEX?
- GWP?

Caveats

- Maximum implementation rates
- Waste diversion: important but requires lead time

Conclusions

- Global baseline trend: +47% by 2030 from 2000, essentially due to growth in developing countries
- Global mitigation potential in 2020 <40 €/tCO_2eq:
  - ~130 Mt CH_4 or ~2.7 Gt CO_2eq
  - -38% relative to baseline (-17% below 2000)
  - ~90% in non-Annex1 countries
  - In China, CH_4 potential constitutes 20-25% of total GHG mitigation potential <100 €/tCO_2eq
- Key mitigation options at the global level:
  - Coal bed methane (gas recovery)
  - Waste treatment (diversion and incineration)
  - Rice (alternative strains, amendments)